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### G81-579 Nebraska Tractor Tests

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## Nebraska Tractor Tests

Nebraska tractor tests provide agricultural tractor users with unbiased information on machine performance.

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### Purpose of the Tests

Nebraska tractor tests are made to provide agricultural tractor users with unbiased information about tractor performance. The test data allows the user to make meaningful comparisons between tractors.

### Nebraska Law and Testing

Provisions for testing tractors are made in the Nebraska Tractor Test law, first passed in 1919 and most recently changed in 1971. This law requires that a stock tractor of each agricultural model (new or used) of 20 or more horsepower offered for sale in Nebraska be tested. In addition, a permit for sale shall be obtained and a full supply of replacement parts be maintained within the state.

The Nebraska Department of Agriculture administers the Tractor Test Law. This department may issue temporary permits for sale if testing cannot be scheduled before a model is offered for sale.

Only one tractor of each model is tested. This tractor is chosen by the manufacturer and is certified as being a production tractor. This procedure ensures that the tractor is one of the better performing units. Random choice of a tractor is not required in order to keep tractor variations to a minimum. This helps to ensure that the results are comparable.

Some tractors do not meet the manufacturers' expectations. These tractors can be withdrawn from testing. A missing number in the sequence of test numbers indicates that a tractor was withdrawn and no test report was published.

## **Tractor Preparation for Performance Runs**

When a tractor is received from the manufacturer, it is assigned a test number and inspected. This is to ensure that it is a standard model. Additional ballast may be added to the tractor as specified by the manufacturer. The static tire loads and inflation pressures must conform to SAE tire standards. No modifications that would void the warranty are allowed. The fuel used and the maintenance operations must all conform to the published information delivered with the tractor.

The engine crankcase is drained and refilled with a measured amount of new oil conforming to specifications in the operator's manual. The tractor is then limbered-up for three hours or more on drawbar work in accordance with the manufacturer's published recommendations. The manufacturer's representative is present to make appropriate decisions regarding mechanical adjustments.

## **Power Take-Off Performance**

### **Maximum Power and Fuel Consumption**

The manufacturer's representative makes carburetor, fuel pump, ignition and governor control settings which remain unchanged throughout all subsequent runs. The governor and the manually operated governor control lever are set to provide the high-idle speed specified by the manufacturer for maximum power. Maximum power is measured by connecting the power take-off to a dynamometer. The dynamometer load is then gradually increased until the engine is operating at the rated speed specified by the manufacturer for maximum power.

This test lasts two hours. If rated engine speed does not provide a standard PTO RPM (540 or 1000), an additional one hour test is made at the standard PTO speed.

### **Varying Power and Fuel Consumption**

Six different power levels are used. They show corresponding fuel consumption rates and how the governor causes the engine to react to the following changes in dynamometer load: 85 percent of the dynamometer torque at maximum power; minimum dynamometer torque 1/2 of the 85 percent torque; maximum power, 1/4 and 3/4 of the 85 percent torque.

This test also lasts two hours with a 20 minute test time at each specified load. Since a tractor is generally subjected to varying loads, the average of the result in this test serve well for predicting the fuel consumption of a tractor in general use.

## **Drawbar Performance**

All engine adjustments are the same as those used in the power take-off tests.

### **Power and Fuel Consumption**

The drawbar power runs are made to show the effects of speed-control devices (engine, governor, automatic transmission, etc.) on horsepower, speed and fuel consumption. These runs are made around

the entire test course, which has two 180 degree turns with a minimum radius of 50 feet. The drawbar pull is set at 4 different loads as follows: 1) as near to the pull at maximum power as possible and still have the tractor maintain rated engine speed on the straight sections of the test course (2 hours); 2) 75 percent of the pull at maximum power (10 hours); 3) 50 percent of the pull at maximum power (2 hours); 4) maintaining the same load and travel speed as in (3) by shifting to a higher gear and reducing the engine RPM (2 hours).

### **Maximum Power in Selected Gears**

Maximum power is measured on straight, level sections of the test course. Some gears or travel speeds are omitted because of high slippage of the drive wheels or because travel speeds would exceed 10 MPH.

Drawbar data are obtained for all gears at rated engine speed that provide wheel slippage less than 15 percent and a travel speed less than 8 MPH. One gear slower than those above will be tested with the load reduced to give approximately 15 percent slip. The engine speed for this gear will be higher than the rated RPM. One gear over 8 MPH but less than 10 MPH will also be tested.

### **Lugging Ability**

Travel speeds corresponding to drawbar pulls beyond the maximum power range are obtained to show the "lugging ability" of the tractor. The run starts with the pull at maximum power; then additional drawbar pull is applied to cause decreasing speeds. The run is ended by one of three conditions: 1) maximum pull is obtained, 2) the maximum slippage limit is reached, or 3) some other operating limit is reached.

## **Sound Measurement**

Sound is recorded during each of the drawbar power and fuel consumption runs as the tractor travels on a straight section of the test course. The dB(A) sound level is obtained with the microphone located near the right ear of the operator. Bystander sound readings are taken with the microphone placed 25 feet from the line of travel of the tractor. An increase of 10 dB(A) will approximately double the loudness to the human ear.

## **Additional Tests**

Tractors equipped with a front wheel drive that can be engaged or disengaged from the driver's seat may require additional drawbar tests. The usual drawbar tests are first run with the front wheel drive disengaged. Then, with the front wheel drive engaged, a maximum power and fuel consumption test of two hours is made. Several gears are selected for additional maximum power runs, one of which will result in about 15 percent slip. The power take-off of some of the large 4-wheel drive tractors does not transmit full engine power. A special test is run at full throttle and minimum throttle setting that allows the power take-off control system to maintain standard PTO speed. In addition, a varying PTO drive and fuel consumption test is made.

## **Test Information**

Test information is published in two forms: a complete individual report is printed for each tractor tested, and a summary booklet, MP 37, *Nebraska Tractor Data*, is published annually for tractors on the market each January 1. Because it is pocket size, only a few key performance figures and specifications

are given. Both publications are available from the Tractor Testing Laboratory, Department of Agricultural Engineering, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln 68583-0832.

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